

Oxidative Radical Addition to Alkenes: a Convenient Route to $\gamma\delta$ -Unsaturated Acids and γ -Lactones

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Summary Diethyl malonate and diethyl alkylmalonates react with olefins and manganese(III) or cobalt(III) acetates in the presence of copper(II) acetate to give diethyl alk-2-enylmalonates which produce upon hydrolysis $\gamma\delta$ -unsaturated acids or γ -lactones.

SYNTHESIS of aliphatic acids *via* malonic esters is usually based on two procedures: (i) alkylation of sodium derivatives of malonic ester with alkyl halides¹ or (ii) free-radical addition of the ester to an olefin in the presence of peroxide

initiators.² We report a modification of the latter pathway, which involves the use of transition-metal salts.

Oxidation of malonic acid esters with these salts in the presence of an alk-1-ene leads to alkyl-substituted compounds. For example, diethyl malonate (0.5 mol) reacts with manganese(III) acetate dihydrate (0.025 mol) and hept-1-ene (0.05 mol) at 90° to afford n-heptyl malonate in 50% yield (based on oxidant).

The addition of catalytic amounts of copper(II) acetate completely alters the course of the reaction. In this case,

